

CLAIMS

*S6
A27*

1. A rotor position estimator for a permanent magnet motor that includes a stator and a rotor, comprising:

- a sensing circuit that generates d-axis and q-axis negative sequence stationary current (NSSC) signals;
- 5 a signal conditioning circuit that combines said d-axis and q-axis NSSC signals with a first positive feedback signal that is based on a rotor position estimate signal to generate modified d-axis and q-axis NSSC signals;
- a regulator coupled to an output of said signal conditioning circuit; and

10 a mechanical system simulator that is coupled to an output of said regulator and that generates said rotor position estimate signal.

2. The rotor position estimator of claim 1 wherein said signal conditioning circuit combines said modified d-axis and q-axis NSSC signals with a second positive feedback signal that is based on a rotor position estimate signal.

3. The rotor position estimator of claim 2 wherein said mechanical system simulator receives a demand torque signal.

4. The rotor position estimator of claim 3 wherein said signal conditioning circuit includes a first multiplier having first inputs that receive said d-axis and q-axis NSSC signals.

5. The rotor position estimator of claim 4 wherein said signal conditioning circuit includes a second harmonic amplifying circuit having an input that receives said rotor position estimate signal and an output that produces said first feedback signal to a second input of said first multiplier.

6. The rotor position estimator of claim 5 wherein said first multiplier multiples said first feedback signal and said d-axis NSSC signal to generate said modified d-axis NSSC signal and multiples said first feedback signal and said q-axis NSSC signal to generate said modified q-axis NSSC signal.

5

A2
667

7. The rotor position estimator of claim 6 wherein said signal conditioning circuit includes a second multiplier having first inputs that receive said modified d-axis and q-axis NSSC signals from said first multiplier and an output that is coupled to said regulator.

8. The rotor position estimator of claim 7 wherein said signal conditioning circuit includes an inverse saliency model that has an input that receives said rotor position estimate signal and that generates said second feedback signal that is output to a second input of said second multiplier.

9. The rotor position estimator of claim 1 wherein said regulator is selected from the group of proportional (P), proportional integral (PI), proportional integral differential (PID), and limited PI regulators.

10. A method for estimating rotor position for a permanent magnet motor that includes a stator and a rotor, comprising the steps of: generating d-axis and q-axis negative sequence stationary current (NSSC) signals;

5 signal processing said d-axis and q-axis NSSC signals using a first positive feedback signal that is based on a rotor position estimate signal; and using a mechanical system simulator that receives an output of said signal processing step to generate said rotor position estimate signal.

11. The method of claim 10 further comprising the step of regulating said output of said signal processing step to produce a regulated signal before using said mechanical system simulator.

12. The method of claim 11 further comprising the step of combining said output of said signal processing step with a second positive feedback signal that is based on a rotor position estimate signal prior to said regulating step.

13. The method of claim 12 wherein said mechanical system simulator has a second input that receives a torque demand signal.

14. The method of claim 13 wherein said signal processing step includes multiplying said d-axis and q-axis NSSC signals by said first feedback signal that is output by a second harmonic amplifier to generate modified d-axis and q-axis NSSC signals.

15. The method of claim 14 wherein said a second harmonic amplifier has an input that receives said rotor position estimate signal.

16. The method of claim 15 further comprising the step of multiplying said modified d-axis and q-axis NSSC signals by said second feedback signal.

17. The method of claim 16 wherein said second feedback signal is generated by an inverse saliency model.

18. The method of claim 17 wherein said inverse saliency model has an input that receives said rotor position estimate signal.

19. A rotor position estimator for a permanent magnet motor that includes a stator and a rotor, comprising:

a sensing circuit that generates d-axis and q-axis negative

sequence stationary current (NSSC) signals;

5 a signal conditioning circuit that combines said d-axis and q-axis NSSC signals with first and second positive feedback signals that are based on a rotor position estimate signal;

a regulator coupled to an output of said signal conditioning circuit; and

10 a mechanical system simulator that has a first input coupled to an output of said regulator, that has a second input that receives a demand torque signal, and that generates said rotor position estimate signal.

A2
(b)2

20. The rotor position estimator of claim 19 wherein said signal conditioning circuit includes a first multiplier having first inputs that receive said d-axis and q-axis NSSC signals.

21. The rotor position estimator of claim 20 wherein said signal conditioning circuit includes a second harmonic amplifying circuit that receives said rotor position estimate signal and that outputs said first feedback signal to a second input of said first multiplier.

22. The rotor position estimator of claim 21 wherein said first multiplier outputs modified d-axis and q-axis NSSC signals.

23. The rotor position estimator of claim 22 wherein said signal conditioning circuit includes a second multiplier having first inputs that receive said modified d-axis and q-axis NSSC signals from said first multiplier.

RECEIVED
U.S. PATENT AND
TRADEMARK OFFICE

A3

24. The rotor position estimator of claim 23 wherein said signal conditioning circuit includes an inverse saliency model that receives said rotor position estimate signal and that outputs said second feedback signal to a second input of said second multiplier.

A4d

A3